IS 4807 (1968): Methods of Testing Viscose Rayon Staple Fibres [TXD 1: Physical Methods of Tests]

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IS : 4807 - 1968

Indian Standard

METHODS OF TESTING VISCOSE RAYON STAPLE FIBRES

First Reprint SEPTEMBER 1978

(Incorporating Amendment No. 1)

UDC 677·463 : 620·1

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

March 1969

AMENDMENT NO. 2 MARCH 1993
TO
IS 4807 : 1968 METHODS OF TESTING VISCOSE RAYON STAPLE FIBRES

(*Clause* **2.3**) Substitute the following for the existing clause:

'2.3 Conditioned Mass

The mass of the textile material conditioned in the standard atmospheric conditions for testing.'

(*Clause* **6.5**) — Delete.

(*Clause* **6.6.2.1**) — Substitute the following for the existing clause:

'6.6.2.1 Benezene - methanol Mixture — 3.2'

(TXD 01)

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Indian Standard
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METHODS OF TESTING VISCOSE RAYON STAPLE FIBRES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 23 October 1968, after the draft finalized by the Silk, Man-Made Fibre and Products Sectional Committee had been approved by the Textile Division Council.

0.2 This standard has been prepared with a view to avoid ambiguity in the testing procedures for various characteristics of viscose rayon staple fibres.

0.3 Considerable assistance has been derived in the preparation of this standard from the following:

JIS L 1015-1959 Testing method for rayon staple

Rules for rayon and staple fibres. The International Bureau for the Standardization of Man-Made Fibres, BISFA-1962.

0.4 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

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1. SCOPE

1.1 This standard prescribes methods for determining the following characteristics of viscose rayon staple fibres:

a) Moisture regain;

b) Fibre length;

c) Denier;

d) Strength and elongation of single fibre :
   1) Dry strength and elongation, and
   2) Wet strength and elongation;

e) Bundle strength (dry);

f) Percentage of finish;

g) Ash content; and

h) Detection of abnormal fibre.

*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Oven-Dry Condition — The condition of viscose rayon staple fibre in which it reaches weight equilibrium at 105° to 110°C.

2.2 Atmospheric Conditions for Testing, Standard — The atmosphere in which physical tests on textile materials are performed. It has a relative humidity of 65 ± 2 percent and a temperature of 27° ± 2°C (*see also* IS : 196-1966*).

2.3 Conditioned Weight — The weight of viscose rayon staple fibre on the basis of its normal condition, that is, oven-dry weight plus conventional allowance of 13 percent.

2.4 Denier — The unit for expressing the linear density of viscose rayon staple fibre; weight, in grams, per 9 000 m of material.

2.5 Moisture Equilibrium — Equilibrium with the standard atmosphere may be deemed to have been reached when successive weighings, at intervals of one hour, of the textile material freely exposed to the moving air, differ by less than 0·1 percent.

2.6 Standard Condition — The condition of viscose rayon staple fibre when it reaches moisture and temperature equilibrium in the standard atmosphere for testing (*see* **2.2**).

2.7 Abnormal Fibre and Other Matters — The contents in rayon staple fibres, such as chips, stuck filaments and hard viscose.

3. SAMPLING

3.1 The quantity of viscose rayon staple fibres of the same grade and quality delivered to a buyer against one despatch note shall constitute a **lot.**

3.2 The number of bales to be chosen at random from a lot shall be as given below. All the bales so selected shall be taken together to constitute the **bulk sample.**

No. of Bales in a Lot	*No. of Bales to be Chosen*
Up to 8	All
9 ,, 25	8
26 ,, 50	13
51 ,, 100	20
101 and above	25

*Atmospheric conditions for testing (*revised*).

3.2.1 A bale may be regarded as consisting of two zones (inner and outer zones) of equal volumes, the edges of the inner zone of the bale being equal to 80 percent of the corresponding edges of the bales. Draw from the outer zone 5 sub-samples, each weighing about 20 to 25 g, in such a way that each sub-sample is taken from a different face of the bale and at random within the face. Cut the inner zone of the bale by two imaginary planes in random positions —one above the centre of the bale and the other below it. Draw two sub-samples each from *A* and *C* (*see* Fig. 1) and the fifth sub-sample from B. In this way, collect from each bale nearly 200 to 250 g of fibres. Mix the fibres uniformly, collected from all the bales constituting the bulk sample. Take about 1 000 g from well-mixed fibres; this shall constitute the **gross sample**.

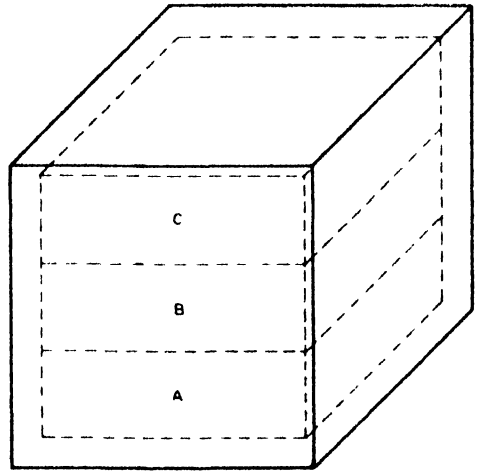

FIG. 1 SAMPLING FROM BALE

3.2.2 Divide the gross sample into 16 equal parts. Take a small quantity of fibres from each of the sixteen parts so as to make a total of 50 g approximately. This shall constitute the **test sample.**

4. ATMOSPHERIC CONDITIONS FOR TESTING

4.1 The tests shall be carried out in standard atmosphere at 65 ± 2 percent relative humidity and $27° \pm 2°C$ temperature (*see also* IS : 196-1966*).

*Atmospheric conditions for testing (*revised*).

5. CONDITIONING OF TEST SAMPLE

5.1 Prior to test, the samples shall be pre-conditioned at a temperature not exceeding 50°C and having a relative humidity between 10 and 25 percent. The fibres shall then be conditioned to moisture equilibrium in standard atmosphere at 65 ± 2 percent relative humidity and 27° ± 2°C temperature.

NOTE — The pre-conditioning conditions may be obtained by heating air at 65 percent relative humidity and 27°C.

5.2 When the fibres have been left in such an atmosphere at least for 24 hours in such a way as to expose, as far as possible, all portions of the fibres to the atmosphere, they shall be deemed to have reached moisture equilibrium.

6. TEST METHODS

6.1 Moisture Regain

6.1.1 *Drying-Oven* — suitable for drying the specimen to constant weight at 105° to 110°C and equipped with a weighing balance capable of weighing the specimen to an accuracy of 0·05 g while suspended within the drying chamber; the holder of the specimen should be of such a type to ensure free access of the dry air to all portions of specimen.

6.1.2 *Procedure* - Divide the gross sample (*see* **3.2.1**) into approximately two equal parts and weigh them accurately. Place each part in the sealed containers; one of these shall be taken for testing and the other shall be kept in reserve in case confirmatory test becomes necessary.

6.1.2.1 Dry the sample to constant weight in the drying-oven and determine the dry weight of the sample.

NOTE — Constant weight shall be deemed to have been reached if the difference between two successive weighings taken at an interval of 20 minutes is less than 0·1 percent of the first of the two weighings.

6.1.3 Determine the moisture regain of viscose rayon staple fibres as given below:

$$M = \frac{W_1 \quad W_2}{W_2} \times 100$$

where

M = moisture regain of viscose rayon staple fibres,

W_1 = original weight of the sample in g, and

W_2 = dry weight of the sample in g.

6.2 Fibre Length

6.2.1 From the test sample (*see* **3.2.2**), take a tuft of fibres whose weight is determined according to the following formula:

$$\text{Weight, mg} = \frac{\text{denier} \times \text{nominal length in millimetres}}{3}$$

NOTE — This will yield approximately 3 000 fibres.

This weight of fibre shall constitute the test specimen. Open up the test specimen. Spread it on a velvet and take 500 fibres at random using tweezers to pick them up near their middles. Place each fibre on a sheet of glass oiled with liquid paraffin or any other suitable oil and straighten it, removing the crimp completely but taking care not to stretch the fibre. Immediately, the fibre has been straightened, measure its length to an accuracy of 0·5 mm. Group the measurements in classes with class interval of 1 mm for a nominal length of less than 45 mm, 2 mm for nominal length between 46 and 80 mm and 5 mm for a nominal length above 80 mm.

6.2.2 *Calculation* — The middle point of the class interval, denoted by l_i, shall be taken to be the length of each fibre in that class. Let n_i denote the number of fibres in the ith class. The mean fibre length L shall be calculated by the following formula:

$$L = \frac{\sum_{i=1}^{k} n_i l_i}{\sum_{i=1}^{k} n_i}$$

where k is number of classes.

6.2.2.1 *Calculation of modal length* — Find out the class interval for which the number of fibres n_i is maximum. The middle point of this class interval shall be taken as the modal or effective length.

6.3 Denier

6.3.1 Take 10 tufts, each of a few milligrams from the test sample (*see* **3.2.2**). Parallelize and carefully clean by hand each tuft of fibre. Straighten the fibres by gently combing the fibres in opposite directions by turn. Holding one end of the tuft, apply a tension [equivalent to tex / (or denier/18)] to remove the crimp. Cut an accurately known length from the middle taking care that no fibre ends protrude anywhere except at the cut ends of the tuft. Place 10 cut bundles on a dark coloured surface and lay them loosely. Draw the fibres from each of the 10 prepared bundles so that all the fibres drawn and put together form a bundle of 50 fibres

Prepare, 10 such bundles in this way. Condition and weigh these bundles separately and determine the mean weight weighing to an accuracy of 0·5 μg for a 1 cm cut length and 1·0 μg for a 2 cm cut length.

6.3.2 Determine the denier of the viscose rayon staple fibre as given below:

$$D = \frac{W}{L} \times 180$$

where

D = denier of viscose rayon staple fibre,

W = weight of 50 fibres in mg, and

L = bundle length in mm.

6.4 Single Fibre Strength and Elongation

6.4.1 *Dry Strength and Elongation*

6.4.1.1 *Apparatus* — A constant-rate-of-load type machine shall preferably be used for the test. Alternatively, a constant-rate-of-traverse or constant-rate-of-extension type machine may also be used.

6.4.1.2 The time of break shall be so adjusted that the specimen breaks after 20 ± 2 seconds of the commencement of the test. Any test result in which the specimen breaks at the clamps or whose rupture occurs within 10 percent or above 90 percent of the scale of the apparatus shall be discarded.

6.4.1.3 Accuracy of the measurement of test results shall be as follows:

Breaking load (in g)	1 percent
Extension (in mm)	0·1 mm

6.4.1.4 *Procedure* — Take a sufficient number of conditioned single fibres such that at least 50 tests are made. Mount a single fibre in the testing machine keeping the distance between the clamps to 10 mm. Apply an initial tension on the fibre to remove the slack. The tension to be applied on the specimens shall be as follows:

d	g
1·5 or less	0·1
Above 1·5 up to 3	0·2
Above 3 up to 7	0·3
Above 7	0·5

Operate the machine until the specimen ruptures. Record the breaking load in grams and the extension in millimetres. Carry out 49 more tests.

Calculate the mean breaking load and elongation of the 50 fibres thus broken.

6.4.1.5 *Calculation* – Calculate the mean tenacity of the fibre in grams per denier as follows:

$$T = \frac{m}{d}$$

where

T = mean tenacity of single fibre,

m = mean breaking load, in g, of the single fibre, and

d = denier.

6.4.2 *Wet Strength and Elongation*

6.4.2.1 *Apparatus* – The apparatus and other related details such as gauge length, recording accuracy of results, etc, shall be the same as for the dry strength (*see* **6.4.1.1** to **6.4.1.3**).

6.4.2.2 *Procedure* – Follow the same procedure as in **6.1.1.4**, except that the test shall be carried out with the fibre immersed in water. A convenient method to perform the test is to fix the dry fibre in the upper grip of the testing machine, immerse it in water, and then fix it in the lower grip. The fibre must remain immersed in water throughout the test but the water must not be allowed to reach the upper grip.

6.4.2.3 *Calculation* – Same as in **6.4.1.5**.

6.4.3 *Ratio of Wet Strength to Dry Strength*

6.4.3.1 The ratio of wet strength to dry strength shall be calculated by the following formula:

$$R = \frac{W}{D}$$

where

R = ratio of wet strength to dry strength,

W = wet strength (*see* **6.4.2.3**), and

D = dry strength (*see* **6.4.1.5**).

6.5 Bundle Strength (Dry) The bundle strength of the fibres shall be determined by the method prescribed in 7 to 11 of IS 8375 1960*.

6.6 Percentage of Finish

6.6.1 *Apparatus*

*Method for determination of bundle strength (tenacity) of cotton fibres

6.6.1.1 *Soxhlet extractor*

6.6.1.2 *Conical flask*

6.6.2 *Reagents*

6.6.2.0 *Quality of reagents* — Unless specified otherwise, pure chemicals shall be employed in tests and distilled water (*see* IS : 1070-1960*) shall be used where the use of water or distilled water as a reagent is intended.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the test results.

6.6.2.1 *Benzene alcohol mixture 1 : 1*

6.6.3 *Procedure*

6.6.3.1 Take about 10 g of fibres and weigh them accurately. Transfer the fibres into a muslin bag which has previously been extracted with the solvent. Transfer the bag along with the fibres to the soxhlet extractor. Weigh the empty flask of the assembly. Introduce into the flask a quantity of benzene alcohol mixture equal to twice the volume of the soxhlet extractor up to the level of the top of the syphon tube. Keep the assembly on a water-bath. Continue the extraction for 8 hours keeping rate of the syphon at 6 c/h.

6.6.3.2 Take out the muslin bag along with the fibres from the extractor. Distill off the solvent. Ensure that no solvent vapour remains in the flask. Remove the flask and clean the outer surface. Dry it in a hot oven at a temperature of 105°C to constant weight for nearly 10 minutes. Cool the flask and weigh the contents to an accuracy of 0·1 mg (W_1).

6.6.3.3 Determine separately the moisture content of the sample under test and from it calculate the dry weight of the test specimen (W_2).

6.6.3.4 Calculate the percentage of finish by the following formula:

$$F = \frac{W_1}{W_2} \times 100$$

where

F = finish, in percent,
W_1 = weight of residue (*see* **6.6.3.2**), and
W_2 = weight of dry fibres (*see* **6.6.3.3**).

6.7 Ash Content

6.7.1 *Procedure* — Take about 5 g of fibres and weigh accurately. Transfer these fibres to a tared silica dish. Heat it over a Bunsen

*Specification for water, distilled quality (*revised*). (Since revised).

burner. After the fibres are carbonized, transfer them to a muffle furnace and keep them there (about 30 minutes) at 700°C, until a white ash is obtained. Cool the dish and weigh accurately the contents.'

6.7.2 Determine separately the moisture content present in the sample under test and from it determine the dry weight of the test specimen.

6.7.3 Calculate the ash content by the following formula:

$$A = \frac{W_1}{W_2} \times 100$$

where

A = ash content, percent,

W_1 = weight of residue (*see* **6.7.1**), and

W_2 = weight of dry sample (*see* **6.7.2**).

6.8 Detection of Abnormal Fibres and Other Matters — Weigh accurately 500 g of fibres from the gross sample (*see* **3.2.1**). Examine them for any abnormal fibres and other matters and isolate them. Weigh the abnormal fibres and other matters so collected. Express this weight as a percentage of the weight of fibre in the sample taken (500 g). This shall be the percentage of abnormal fibre and other matters in the sample. It is advisable to process the sample through a Shirley Analyser and then sort out the droppings by hand for abnormal fibres and other matters.

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